

## ESV '01 GOVERNMENT OF CANADA STATUS REPORT

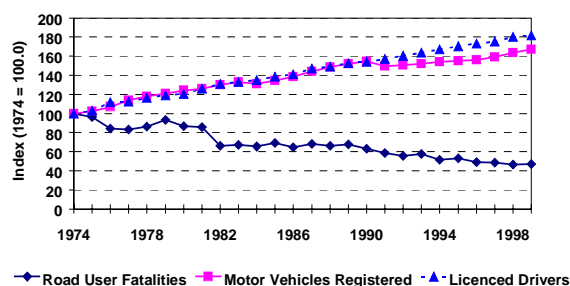
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Transport Canada  
Canada

### CANADIAN ROAD SAFETY SITUATION

The responsibility for road safety in Canada is shared among the federal and the provincial/territorial governments. While the federal government is primarily responsible for the safety of new vehicles and inter-provincial commercial carriers, the provincial governments are responsible for the operation and maintenance of motor vehicles and the road infrastructure.

Over the past 25 years, fatalities resulting from motor vehicle collisions have declined by over 50% despite the fact that the number of registered vehicles and licensed drivers have both doubled during this period of time.



Canada's Road Safety Vision 2001 — 'to have the safest roads in the world' — and its plan to achieve the vision, were adopted by the Council of Ministers of Transportation and Highway Safety in 1996. Initiatives undertaken in support of the vision have helped progress the plan's strategic objectives to heighten awareness of road safety issues among the general public, to foster cooperation and collaboration among road safety agencies, to provide more focused enforcement and to improve data quality and collection practices.

Canada's level of road safety during 1998, as measured by road users killed per registered motor vehicle, improved by almost 9% since the vision was adopted in 1996. During the same three-year period, the actual number of road users killed and seriously injured decreased by 5% and 8%, respectively, under comparable 1996 figures. There has been a 13% decrease in the percent of fatally injured drivers who had been drinking and the national seat belt usage

rate has increased slightly to 90%. Although Canada's fatality rate per 10,000 motor vehicles registered decreased from 1.79 in 1996 to 1.63 during 1998, its international ranking among Organization for Economic Co-operation and Development (OECD) member countries slipped to 9<sup>th</sup> from 8<sup>th</sup> during 1996 and 1997 because some other countries achieved even more impressive gains during the same period.

In the Fall of 2000, the Council of Ministers agreed that Canada should retain the vision of having the safest roads in the world, and that a longer term successor plan, called Road Safety Vision 2010, carry forward the work of Canada's inaugural national road safety plan. It was further agreed that the plan include an overall national target and sub-targets.

A national target that calls for 30% decreases in the average number of road users killed and seriously injured during the 2008-2010 period below comparable 1996-2001 figures is currently under consideration. Achievement of this target would reduce Canada's road fatality total to fewer than 2100 by 2010. The proposed sub-targets address:

- seat belt wearing rates and proper use of child restraints by all motor vehicle occupants;
- the number of unbelted fatally or seriously injured occupants;
- the percent of road users fatally or seriously injured in crashes involving a drinking driver;
- the number of road users fatally or seriously injured on rural roadways.

### DATA COLLECTION AND ANALYSIS

#### Electronic Data Recorder (EDR) Data Analysis

Transport Canada (TC) is conducting a series of pilot studies to evaluate the mechanisms for retrieval and analysis of data from on-board crash recorders that are installed in late model vehicles, and to determine the utility of these data over a broad spectrum of collision types. Cooperative research between the Department and vehicle manufacturers provides for the use of both publicly available data retrieval systems and proprietary devices. Issues of specific interest being addressed by this research include the real-world performance of advanced air bag systems, and human factors associated with the pre-crash phase of collisions.

## **Canadian Vehicle Use Survey**

In 1999, Statistics Canada conducted the first Canadian Vehicle Use Survey on behalf of Transport Canada to obtain annual estimates of the amount of road travel in this country. The survey, which is undertaken annually, includes data on the annual number of kilometres driven by all major vehicle types; age and gender of drivers; number of passengers carried; time of day and season; types of road traveled; and volume and types of goods that commercial vehicles transport. The survey information will be used to monitor vehicle-use changes over time, as well as to monitor how vehicle use affects safety, fuel consumption and the environment. Survey results will also provide risk management indicators to help develop more informed safety initiatives and policies. More accurate inter-provincial and international road safety comparisons will also be possible from previously unavailable national vehicle kilometrage data.

## **System for Technological Applications in Road Safety (STARS)**

In partnership with selected provincial governments, public insurance companies and police agencies, Transport Canada is conducting a feasibility study of a computer- and communications-based system called the System for Technological Applications in Road Safety (STARS). This multifaceted technological platform has many potential uses, including the automated on-site collection of all traffic collision data; access to licence, registration and insurance files; ticketing and on-site collection of fines using bank credit cards; and scheduling court appearances. The STARS feasibility study is intended to provide a national focus for the development of uniform automated data collection performance standards. Adopting STARS would improve the efficiency, quality and timeliness of traffic collision data collection and would facilitate data interchange to develop national road safety programs.

## **Crash Taxonomy and Target Groups**

A taxonomy (classification scheme) has been developed to categorize and quantify subsets of crashes, or “target groups”, that would be affected by particular vehicle-based crash avoidance safety measures. The project is intended to provide objective first-order estimates for target groups

which can then be combined with data on estimated effectiveness, performance, and costs to produce cost-benefit estimates for individual safety measures. In turn, these estimates will help to prioritize Transport Canada’s motor vehicle research and regulatory agenda and harmonization initiatives to achieve the greatest practicable rate of reduction in road crashes and casualties.

The taxonomy has been applied to five years’ (1993-97) of data from TRAIID (TRAffic Accident Information Database), the Canadian national file of police accident reports. Crashes are classified according to:

- traffic units involved - motor vehicles, motorcyclists, cyclists, and pedestrians
- vehicle type - passenger car, light truck or van, heavy truck (with and without trailers), buses and motorcycles
- crash configuration - rear-end, lane change, backing, run-off road, intersection crossing path, head-on and rollover.

Detailed analysis of the data is underway to assess the number and severity of crashes in numerous target groups for potential crash avoidance safety measures such as antilock brakes, anti-rollover measures, and adaptive cruise control.

## **Rollover Crashes**

The increase in popularity of sport-utility vehicles and minivans in recent years has focused attention on how such vehicles differ from passenger cars in their safety characteristics and collision involvement. As well, the U.S. announcement in 2000 of rollover crash ratings has created considerable public interest in Canada.

The Department has completed a preliminary analysis of rollover crashes in Canada based on 1993-97 data. On the basis of vehicle registrations, light trucks and vans (LTVs) are over-involved in single-vehicle rollover crashes compared to passenger cars – 15% more fatal, 4% more non-fatal injury and 43% more property damage-only rollover crashes. However, on a per-rollover basis, killed and injured LTV occupants are under-represented by 9% and 14% respectively compared to passenger car occupants.

The goal of this work is an assessment of potential rollover countermeasures such as dynamic tests, or consumer information programs to provide rollover data on specific vehicle makes and models. However, more detailed information is needed on, for example, the relative numbers of rollovers that occur on- and off-road, or that are tripped or untripped, as well as experimental data on vehicle dynamic response to sudden steer inputs and tripping mechanisms.

## **CRASH AVOIDANCE RESEARCH**

### **New Technology Evaluation**

A number of experiments have been done to investigate the performance characteristics of several new technologies that have recently been introduced on production passenger cars. Studies were done on adaptive cruise control (ACC), infrared night vision, and near-field obstacle warning.

In general, the systems performed according to their manufacturers' claims, but also demonstrated shortcomings. The ACC system sometimes accelerated in curves despite the presence of a vehicle ahead, the minimum headway was felt to be too short in certain traffic situations, and the system would not react to stationary vehicles and other obstacles. The night vision system reliably displayed other vehicles, pedestrians and animals at distances beyond normal headlamp range, but did not reveal cold objects such as exhaust silencers or packages on the roadway. Drivers also found it distracted them from their normal visual scanning pattern. The near-field obstacle warning system provided reliable warnings for typical obstacles only within 1 to 2 metres of the vehicle. Therefore, vehicle speed needed to be very low to ensure the driver could brake in time to avoid hitting the obstacle. These findings underline the need for drivers to continue to exercise normal caution when using these systems.

While manufacturers are emphasizing the convenience of these systems, their characteristics may also provide important safety benefits. More evaluations are planned, on both improved versions of the systems studied so far, as well as future new crash avoidance systems. Much work remains to be done before specific effects upon crash risk can be determined. A major concern is the possibility that drivers will adapt to the new systems by reducing their vigilance or taking more risks.

## **School Bus-Pedestrian Collision Countermeasures**

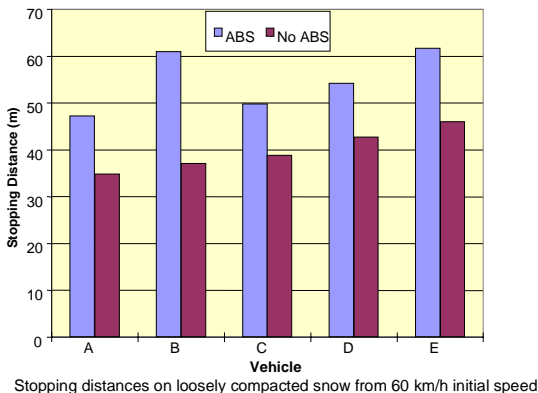
In an effort to minimize the threat to the safety of children when vehicles illegally pass stopped school buses, the red "stopped school bus" warning lights, supplementary yellow warning lights (both mounted at the roof of the bus) or the yellow hazard warning lights, depending on the province, are activated some distance before a stop to warn surrounding traffic that the bus is stopping for children. These systems may differ in effectiveness and the diversity of practice creates uncertainty for out-of-province drivers.

Transport Canada is leading a research project to evaluate the three pre-stop warning light systems. Video and radar speed data on school buses in actual service were collected in Ontario and Saskatchewan (red special warning lights) and Québec (yellow special warning lights and hazard warning lights). The data are now being analysed to determine the relative effectiveness of the three systems in inhibiting illegal passing.

In Canada, about five deaths a year result from school buses striking children at school bus stops. Transport Canada has introduced safety regulations for new school buses requiring improved front crossview and rearview mirrors, and the stop signal arm. Provincial laws have mandated the use and maintenance of these devices. However, in addition to the equipment required by regulation, many operators have installed other pedestrian collision-oriented safety devices such as physical barriers, sensors and warning systems on their buses. Two questions arise. How effective are these safety devices? Are any of them effective enough to justify mandating them on new buses?

A survey, directed at local school authorities, bus fleet operators and Canadian provincial and U.S. state pupil transportation agencies is currently documenting the experience of U.S. and Canadian school bus fleets with these devices, including any benefits and disadvantages. A secondary objective is to estimate the installation and usage rates of such devices. Survey results will be shared with school transportation authorities and bus fleet operators to help them make objective decisions on future safety equipment and operational practices aimed at eliminating accidents involving buses and pedestrians.

## Light Duty Vehicle Anti-lock Brake Systems (ABS)



In recent years, ABS has become popular as standard and optional equipment, but is not mandatory, on light vehicles (passenger cars, vans and trucks) sold in Canada. Transport Canada has received numerous public complaints about excessively long stopping distances on snow, slush and gravel, known generically as “deformable” surfaces, with ABS equipped vehicles. In response to the public concerns and the findings of related defect investigations, TC is conducting research on the braking (stopping and stability) performance of light vehicle ABS on deformable surfaces.

Preliminary tests conducted in 2000 on five passenger vehicles showed that stopping distances on snow covered surfaces were 21 to 48 percent longer with ABS operating than with ABS deactivated. Additional testing was done in 2001 to quantify the effects of snow tires vs. four season tires on ABS stopping distances.

There is considerable interest in the effects of ABS systems upon crash risk. The Department is analysing crash data to compare the frequency, severity and types of crashes involving vehicles with standard ABS and those on which ABS is not available.

The results of this ABS research will be used to support decisions on whether to make ABS mandatory on all vehicles, and whether requirements relating to ABS performance on deformable surfaces should be introduced even if ABS fitment remains at the manufacturer’s discretion.

## Intelligent Transportation System (ITS)

As part of the crash avoidance research program, studies have been initiated to investigate the influence of on-board ITS information, control and communication systems on traffic safety with a view towards developing a scientific basis for national policies, vehicle regulation and other interventions. This research program is expected to lead to recommendations concerning regulatory initiatives, result in improved safety of international standards, influence industry to design safer products, provide a safety perspective to departmental programs related to ITS, identify other interventions including communication activities such as public awareness campaigns and consumer information leaflets, provide an informed basis for communication with the public concerning ITS safety issues, and support federal leadership on matters within provincial jurisdiction such as the regulations concerning aftermarket products and matters involving operational aspects of ITS.

Transport Canada’s ITS road safety research program comprises four key elements:

- (1) International Harmonized Research Activities (IHRA) collaborative research leadership;
- (2) research in support of ITS international standards;
- (3) development of ITS safety test and evaluation methodology; and
- (4) safety evaluation of commercially available ITS systems supporting Canada’s role in leading the IHRA ITS Working Group as well as government regulatory and communication clients, international standards bodies, provincial jurisdictions, the ITS research community, industry and the public.

Two studies that are part of this program are noteworthy. A study of driver visual scanning while using a hands-free cellular telephone is part of a multi-year research program designed to explore theoretical issues associated with driver visual performance as it may be influenced by a variety of ITS devices, and their implication for traffic safety. The research will consider a variety of ITS applications. In the present study, changes in drivers’ visual scanning patterns associated with the use of hands-free cellular telephones will be investigated.

The study will involve the use of our instrumented research vehicle and on eye tracking system, Vision 2000.



A study of behavioural adaptation to lane departure warning system is part of a series of studies that are underway to explore potentially important factors underlying behavioural adaptation as a predictable human response to changes in technology. The studies will be conducted using Transport Canada's STISIM simulator to identify specific factors, such as feedback latency, safety consequences, driver trust and information reliability, that may be potentially important to include in the model. The study currently underway investigates the effects of lane departure warning system reliability and driver characteristics on behavioural adaptation. In addition, the study investigates what happens when system functional characteristics change unpredictably. A complimentary closed-course study using our instrumented research vehicle is also underway.

## **CRASHWORTHINESS RESEARCH/FIELD COLLISION INVESTIGATIONS**

### **Frontal Crash Protection**

At the last ESV Conference, Transport Canada presented research results which highlighted the need to broaden the scope of regulated frontal crash testing environments to include tests with fifth percentile female Hybrid III dummies to ensure the frontal protection requirements of occupants of short stature are addressed. Our research efforts in this area culminated in the development of two separate testing protocols. One involved the use of fifth percentile female Hybrid III dummies in a 48 km/h full frontal rigid barrier test; the other, in an up-to-40 km/h offset frontal deformable barrier test. In both instances, the tests are performed with the seats in

the full forward positions. Both of these testing protocols have been adopted in the final U.S. rule on advanced air bags issued by NHTSA and will be included in Canada's forthcoming amendment of CMVSS 208. As part of a cooperative research initiative with NHTSA, Transport Canada is utilizing both of these tests to monitor the crash performance of newer vehicle models incorporating "advanced" air bag technologies. We are also closely monitoring the actual crash performance of air bag systems in Canada using our network of university-based collision investigation teams. Here again the focus is on newer vehicle models.

Over the past year, considerable effort has also been expended to develop an improved, more realistic, 'worst case' test procedure to assess out-of-position injury risk to short drivers from air bags. The need to revise existing test procedures evolved from collision investigation and reconstruction studies of Canadian air bag fatality cases. To date, we have completed more than 40 tests as part of this research initiative, and are satisfied with the evaluation of thoracic injury risk obtained with our new and improved test procedure.

### **Side Impact Protection**



Over the last few years, vehicle manufacturers have implemented numerous vehicle design changes in an effort to improve side impact protection. The fitment of side air bags is becoming common place. Transport Canada has implemented a comprehensive test program to evaluate the benefits of these new changes as well as to evaluate the risk of injury posed by side air bags, particularly to out-of-position children. Much of this effort is in support of the IHRA. The test programme includes both car-to-car and SUV-to-car full scale testing with emphasis on

the evaluation of protection requirements of adults of shorter stature in the front seats and adolescents and children in the rear seats. New moving deformable barrier designs, more representative of today's vehicles, especially their geometric profile, are being evaluated as part of this programme. This effort is being coordinated with those of both the NHTSA and the Insurance Institute for Highway Safety.

Transport Canada recently developed a number of new testing protocols to evaluate injury risk to out-of-position children from side air bags. These testing protocols have been incorporated in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Air Bags prepared by the Side Air Bag OOP Technical Working Group chaired by the Insurance Institute for Highway Safety. In turn, Transport Canada recently signed a Memorandum of Understanding (MOU) with Canadian vehicle manufacturers and importers wherein the latter have agreed to abide by these recommendations in future side air bag designs marketed in Canada. We believe that this agreement will have a significant impact on reducing the risk of injury to child occupants. In addition, Transport Canada has conducted approximately 30 in-position tests of appropriately restrained child occupants to assess the risk of injury and structural damage to child seats from side air bags.

Last year, Transport Canada sponsored close to 60 pendulum tests to evaluate the proposed variations of the EuroSID2 (ES2) dummy. Further full-scale vehicle tests utilizing the latest EuroSID 2 dummy are planned. Transport Canada is also actively participating with both the IHRA and ISO in the development of the WorldSID dummy. The alpha version of WorldSID recently underwent biofidelity testing at our test facility in Blainville, Quebec.

Several years ago, a major directed study of side impact crashes was initiated by Transport Canada. To date, over 100 real world crashes, which closely approximate the staged collisions used for side impact compliance testing, have been completed. This programme of collision investigation was initiated to examine the extent to which vehicle damage patterns using different deformable barrier designs and the associated measured crash test dummy responses match damage and injury trends observed in actual Canadian field collisions. With the growth in popularity of light trucks and vans, in general, sport utility vehicles, in particular, we are increasingly concerned about the incompatibility

which results when these vehicles interact with smaller passenger cars. The potential problems which arise due to vehicle incompatibility and possible short and long term countermeasures which can be implemented to improve the level of self-protection afforded occupants of passenger cars is being studied.

### **Occupant Restraint Fitment**

In the area of occupant restraint fitment, two projects have been initiated to facilitate regulatory development of seat belt requirements. The first is the development of an electronic belt fit test device (eBTD). This work is being coordinated by the joint government-industry-working group on abdominal injury reduction. A beta version of the RAMSIS-compatible software is now available and will be validated over the next few months. This work is expected to culminate with an MOU with industry.

The second project is the development of a BTM module for use with the Automotive and Seat and Package Evaluation and Comparison Tools (ASPECT) H-point mannequin. ASPECT is expected to replace the current H-point mannequin in SAE recommended practice J826, which is widely used to represent the positioning of vehicle occupants in design and safety regulations. The purpose of this work is to modify ASPECT to incorporate belt-fit test criteria in order to be able to facilitate future regulations involving the BTM. The ASPECT BTM project is evaluating the biofidelity and adaptability of the BTM with the ASPECT mannequin. Based on this evaluation, functional lap and torso contours will be created for the ASPECT mannequin, and application procedures for evaluating seat belt geometry in the ASPECT environment will be developed and tested. Finally, computerized methods for evaluating seat belt-fit that are linked to the physical measurements will be developed.

A study has also assessed the usability of a wide variety of currently available Child Restraint System (CRS) harness design features. Forty-two participants installed child test dummies in both forward- and rear facing CRS harnesses, either inside or outside a test vehicle. While the percentage of correct installations exceeded 85% for all designs when installed in the forward-facing configuration, between 19 and 45% of rear-facing installations were performed incorrectly. These results suggest that convertible CRS's lack adequate usability when they



are used in the rear-facing configuration (i.e., that specified for children under 9-10 kg), which may compromise a child's safety in the event of a collision. In order to improve CRS harness usability and decrease the number of installation errors, the adoption of a standardized CRS harness usability test protocol that can be implemented by manufacturers during the design process is proposed.

### Trailer Rear Underride



A research program was undertaken to determine the desirable performance characteristics of rear underride guards for trailers and in particular their compatibility with compact and sub-compact passenger cars.

A series of eleven full vehicle crashes was performed to determine the effectiveness of a guard built to the minimum requirements of the U.S. FMVSS 223 (Rear Impact Guards) in preventing passenger compartment intrusion (PCI). The tests performed suggest that such a guard may not be strong enough to prevent PCI and may be inadequate in protecting front seat occupants of compact and sub-compact passenger cars which are more common in Canada than in the U.S. The test results suggest that a stronger guard be required to prevent PCI in compact and sub-compact passenger cars.

The first ten tests involved crashes of passenger vehicles into impact guards mounted on a fixed barrier. Test speed, guard design features and vehicle model were varied.

The final test involved a 1998 Honda Civic car colliding at 56 km/h into a empty van trailer (worst case scenario) equipped with a guard capable of resisting a full-width load of 400 kN. There was no PCI and the data gathered from the two dummies suggested that occupants would have likely survived

the collision. A regulatory proposal to require rear underride guards on new commercial trailers offered for sale in Canada is being developed taking into account the results of the above research.

## VEHICLE SAFETY REGULATIONS

### Recent Past

Canada was the first country in the world to initiate a performance based snow tire standard. Snow tires sold in Canada which meet the ASTM performance based standard can be marked with the mountain/snowflake symbol. The initiative done in collaboration with the tire industry was announced by the Minister of Transport in February 1999.



Canada also led the way globally by introducing a strength requirement for the load anchor points on commercial trailers. Transport Canada along with other federal and provincial agencies worked in partnership to develop a comprehensive set of cargo security regulations. This series of regulations formed the basis for those recently proposed in the U.S.

Transport Canada introduced anti-lock braking requirements for large trucks. This requirement and the recently introduced braking requirements for light duty vehicles, result in the Canadian requirements being harmonized with those of the U.S.

### Current

A new requirement for the installation of lower anchorages to secure child seat in vehicles will soon be issued. The regulation will require manufacturers to install solid anchorage points in vehicles which will allow a means of solidly affixing the child seat in a vehicle, thus significantly enhancing child safety. It is expected that vehicles sold in Canada after September 1, 2002 will have to be equipped with

child seat anchor points.

The body panel joint strength requirement for school buses was upgraded to require buses under 4,536 kg to meet the same safety performance requirements as larger buses. Previously these smaller vehicles were exempt from the regulations.

Transport Canada is in the final stages of revising the fuel system safety requirements for alternative fueled vehicles. The amendments will extend to natural gas vehicles the alternative of following construction codes in lieu of crash testing. This option is currently available only for propane vehicles.

### **Future**

Transport Canada is beginning a public process to obtain stakeholder input for the development of a regulation governing frontal occupant protection during a collision. While the current CMVSS 208 is among the world's most stringent frontal impact testing requirements, it only requires testing the vehicle's occupant protection system by using an average size (50<sup>th</sup> percentile) male dummy in a solid barrier crash at 48 km/h. A Notice providing details on the Department's intent to broaden the current testing requirements to include additional dummies and testing protocols is being prepared and should be published this spring. The Department believes that the proposed amendments are required to ensure that future vehicles are capable of protecting a broader range of vehicle occupant sizes and ages and to lower the risk to occupants who happen to be out-of-position when a collision occurs and an air bag deploys.

There are currently several regulatory items that are in progress or will be initiated in the near future including:

- Introduce a new underride guard regulation (CMVSS 223)
- Introduce crash testing requirements for electrolyte spillage and electrical shock protection for electric vehicles (CMVSS 305)
- Amend school bus mirror requirements (CMVSS 111)
- Amend Head Restraint requirements (CMVSS 202)
- Review theft and brake shift interlock requirements (CMVSS 114)
- Amend the occupant protection requirements (CMVSS 201)

- Complete the joint TC/NHTSA door lock testing program and amend the testing requirements (CMVSS 206)
- Review the proposed NHTSA requirements for rear impact fuel system integrity at 80 k/hr (CMVSS 301)
- Review the need for tire pressure monitoring systems and review the need to update the current tire testing regulations

### **Global Agreement on Technical Regulations**

Canada became a contracting party to this Agreement in 1999. This Agreement, developed under the auspices of the United Nations' Economic Commission for Europe (ECE), has created a truly international process for the harmonization of motor vehicle regulations in the areas of safety, emissions and fuel efficiency. The work under this Agreement is beginning with the determination of priorities for global technical regulations (GTR). The creation of the first GTR is likely to take several years to achieve. The work of the IHRA under ESV is critical to the success of the achievement of global harmonization of regulations. Canada is strongly in favour of a clear linking of IHRA and Global Agreement initiatives in order to promote regulatory harmonization.